Dec. 2, 1969 L. T. WARD 3,481,405

FIRE FIGHTING AIRCRAFT

Filed Nov. 13, 1967

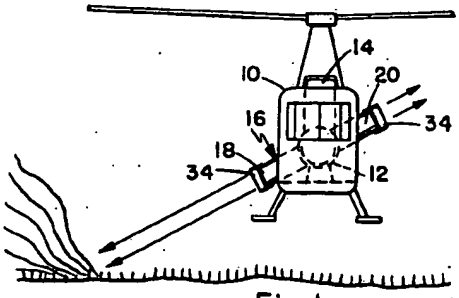

Fig. 1

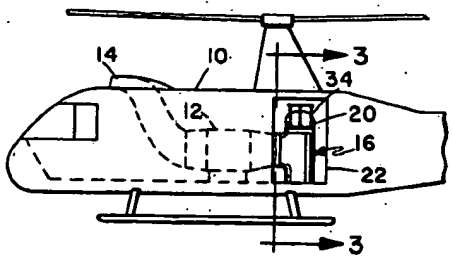

Fig. 2

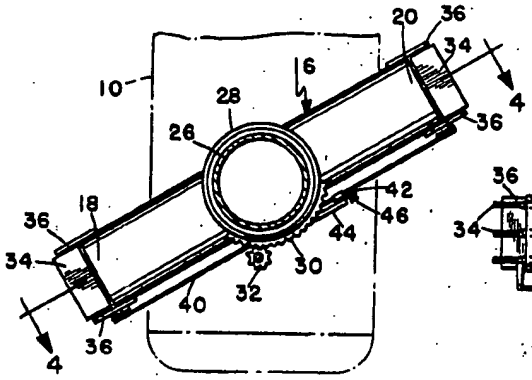

Fig. 3

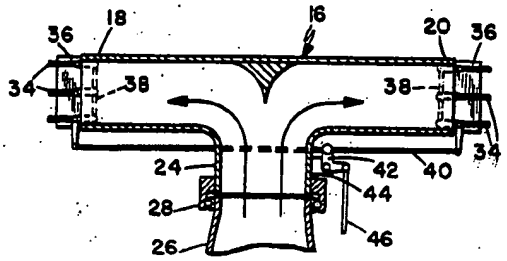

Fig. 4

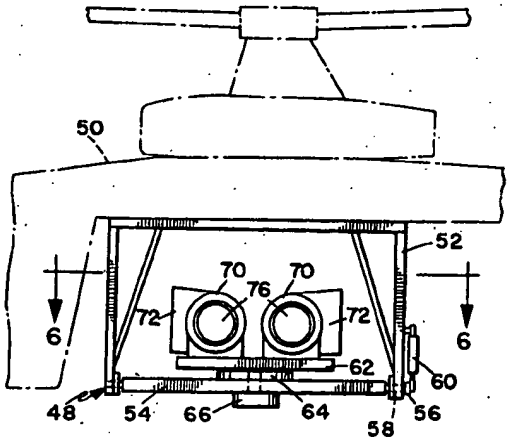

Fig. 5

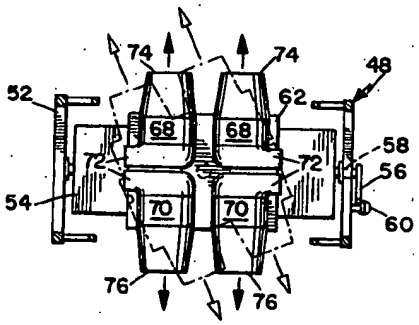

Fig. 6

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U.S. Cl. 169—1 6 Claims

ABSTRACT OF THE DISCLOSURE

An aircraft capable of very low speed flight, such as a helicopter, is adapted to carry a gas generator which produces a high velocity jet flow of non-combustible gas, the apparatus including means for directing the jet to a fire to extinguish the fire and blow away or erode combustible surface material in the fire zone. The jet is expelled equally in opposite directions from the aircraft, so that there is no reactive force applied to deflect the aircraft from its line of flight.

BACKGROUND OF THE INVENTION

The present invention relates to fire fighting apparatus and specifically to a fire fighting aircraft.

In fire fighting, particularly in the case of brush or forest fires, it has become common to drop chemicals, water and various fire retardants on the fire from aircraft. Many different techniques have been devised for spraying or otherwise distributing the retardant materials over selected areas. In all such techniques, however, particularly in widespread or intense fires, the effect is only temporary and it is customary to use a large ground crew of personnel to enter the treated area and complete the job, usually by clearing a fire break to stop the advancing flames. The process is very time consuming and dangerous.

SUMMARY OF THE INVENTION

The apparatus described herein can be incorporated into various conventional helicopters or can be constructed as a complete assembly to be suspended from a helicopter. One or more gas generators, such as conventional turbojet engines, are mounted so that the exhaust is directed to the side of the helicopter, equally in opposite directions to avoid any offset thrust reaction. This can be accomplished by identical opposed engines, or a split nozzle on one engine. Control means is provided to incline the jet nozzle downwardly on one side to direct the exhaust gases at a fire on the ground below and to the side of the helicopter, which is flown along the fire front. The gases can also be deflected through a limited angle from front to rear to facilitate sweeping an area of fire while the helicopter hovers or moves very slowly. Jet engine exhaust gases lose their heat very rapidly and, at a short distance from the nozzle are sufficiently cool to avoid any possiiblity of initiating combustion, particularly since a jet engine is quite efficient in combustion and the gases are essentially non-combustible. The jet velocity, however, is very high for a considerable distance from the nozzle, being sufficient for the present purpose at as much as 50 or 100 feet, depending on the size of engine used. In addition to blowing out the flames in the immediate area and distributing non-combustible gases over the surrounding area, the force of the jet exhaust is sufficient to blow loose debris back into the fire and even to erode the surface and uproot grass and light brush. This, in effect, creates a fire break simultaneously with subduing the flames and requires very little added work by ground crew.

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is a front elevation view of a typical helicopter with the fire fighting apparatus installed and showing the operation;

FIGURE 2 is a side elevation view of the helicopter;

FIGURE 3 is an enlarged sectional view taken on line 3—3 of FIGURE 2;

FIGURE 4 is a sectional view taken on line 4—4 of FIGURE 3;

FIGURE 5 is a side elevation view of a fire fighting unit for attachment below a helicopter; and

FIGURE 6 is a sectional view taken on line 6—6 of FIGURE 5.

Similar characters of reference indicate similar or identical elements and portions throughout the specification and throughout the views of the drawing.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the configuration shown in FIGURES 1–4, the apparatus is installed inside a conventional cabin type helicopter 10 and includes a gas generator 12 having an air inlet 14 well clear of the exhaust gas zone. The gas generator may be a conventional type of turbojet engine and is mounted in the helicopter in any suitable manner, the longitudinal arrangement shown being used to simplify the nozzle structure.

At the rear of gas generator 12 is a bifurcated nozzle 16 having a pair of opposed outlets 18 and 20 which project through openings 22 in the sides of the helicopter. Nozzle 16 has a sleeve portion 24 which is coaxially coupled to the tail pipe 26 of the gas generator by a ring bearing 28, so that rotation of the nozzle will direct the outlets up or down from the helicopter. To rotate the nozzle 16, a gear sector 30 is secured on the portion of ring bearing 28 carried by the nozzle, and a pinion 32, coupled to any suitable manual or power operated control means, engages the gear sector. Other means for rotating the nozzle may be equally suitable.

Across each outlet of nozzle 16 are vanes 34 pivotally mounted between brackets 36 to swing about axes substantially perpendicular to the rotational axis of the nozzle. All of the vanes at each outlet are connected by links 38 to swing in unison, and the two sets of vanes are interconnected by an actuating rod 40 which is coupled to a bell crank 42 pivotally mounted on a bracket 44 on sleeve portion 24. From bell-crank 42 a control rod 46 extends to any suitable control means. When control rod 46 is moved, one set of vanes 34 will swing in a forward direction and the other set will swing in the opposite, or aft direction.

In operation the helicopter is flown at low altitude along the edge of a fire and nozzle 16 is rotated to direct the exhaust from gas generator 12 down to the burning area to be extinguished. Due to the bifurcated nozzle, an equal flow of gas is ejected in the opposite direction, so cancelling any offset thrust on the helicopter and making it simpler to fly where needed. This equal and opposite reaction is maintained regardless of the position of the nozzle. The blast of the jet exhaust will blow the flames back and the non-combustible gases will subdue combustion. In addition, loose combustible material will be blown back into the fire and grass and small brush will be loosened and blown back as the jet exhaust erodes the surface of the ground. Thus a fire break is made as the fire is being extinguished along its edge. The helicopter can be maneuvered as necessary to follow the fire and, where necessary, the vanes 34 can be used to sweep the jet exhaust back and forth across a selected area. Such a procedure greatly reduces the need for a ground crew and, when personnel are used in the area, the presence of the helicopter is a safety factor.

It will be obvious that any reasonable number of gas generators may be used, either coupled to a single bifurcated nozzle, or with individual nozzles, as long as the gas flow is equally opposed to prevent offset thrust.

A multiple unit suitable for use on large helicopters is shown in FIGURES 5 and 6. This unit 48 is self-contained and can be suspended from a helicopter or attached as a pod to a helicopter of the "flying crane" type, indicated in a broken line at 50 in FIGURE 5. A frame 52 of any suitable structure has a rocking platform 54 pivotally mounted at the lower end thereof to swing about a longitudinal axis relative to the aircraft. An arm 56 on hinge shaft 58 is connected to a jack 60 mounted on the frame 52, to adjust the inclination of platform 54 to either side. On top of the platform 54 is a rotary platform 62 mounted on a turnatble 64 and driven by a motor 66. Any conventional means may be used to move the platforms, that shown being substantially diagrammatic.

Mounted on platform 62 are paired gas generators 68 and 70, two pairs being shown as an example, all the gas generators having inlets 72 directed to avoid ingestion of combustion gases. Each pair of gas generators 68 and 70 has outlets 74 and 76, respectively, opening in opposite lateral directions for balanced thrust. Sweeping of the jet exhaust from front to rear is accomplished by rotating platform 62, as indicated in broken line in FIGURE 6. In the open frame unit this is more practical than multiple sets of interconnected vanes, and the gas generators can be balanced about the axis of rotation to minimize loads.

By making successive passes, or using several helicopters in series, it would be possible to subdue a fire and make a fire break along a considerable frontage of a fire in a short time. With suitable fuel supply a helicopter could opearte for some time continuously and sustain its fire fighting action in a particular area, as opposed to the chemical or water dropping operations which require frequent round trips for refilling.

It is understood that minor variation from the form of the invention disclosed herein may be made without departure from the spirit and scope of the invention, and that the specification and drawing are to be considered as merely illustrative rather than limiting.

What is claimed is:

1. In combination with an aircraft capable of very slow and hovering flight, fire fighting apparatus comprising:

gas generator means for generating a high velocity flow of substantially non-combustible gases;

said gas generator means being mounted on the aircraft and having at least one pair of equal flow outlets in fixed, axially opposed relation to each other and opening to opposite sides of the aircraft for balanced thrust; and

directing means coupled to said outlets to direct selectively angularly downwardly on their respective sides of the aircraft.

2. The structure of claim 1, and including means for directing the gas flow from said outlets angularly from front to rear relative to the aircraft and in opposed directions on opposite sides of the aircraft.

3. The structure of claim 1, wherein said outlets are at opposite ends of a bifurcated nozzle coupled to said gas generator means and mounted to rotate about an axis substantially parallel to the longitudinal axis of the aircraft, with the outlets protruding from opposite sides of the aircraft.

4. The structure of claim 3, and including vanes across each of said outlets, pivotally mounted to swing about axes substantially perpendicular to the rotation axis of said nozzle; and

actuating means interconnecting said vanes at the opposed outlets to swing the vanes in opposite directions.

5. The structure of claim 1, and including a rocking platform on which said gas generator means is mounted, said platform being pivotally attached to the aircraft on an axis substantially parallel to the longitudinal axis of the aircraft;

said directing means comprising actuating means for inclining said platform to either side.

6. The structure of claim 5, and including a rotatable platform mounted on said rocking platform for rotation about an axis substantially perpendicular to the pivotal axis of the rocking platform, said gas generator means being mounted on said rotatable platform; and

means to rotate said rotatable platform through a limited angular range to swing said outlets from front to rear.

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U.S. Cl. X.R.

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